HE HMMWV (XM1124)
Tri-Service Power Expo
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Scott Doudna
HE HMMWV Engineer
PM Light Tactical Vehicles
(586) 753-2638
doudnas@tacom.army.mil

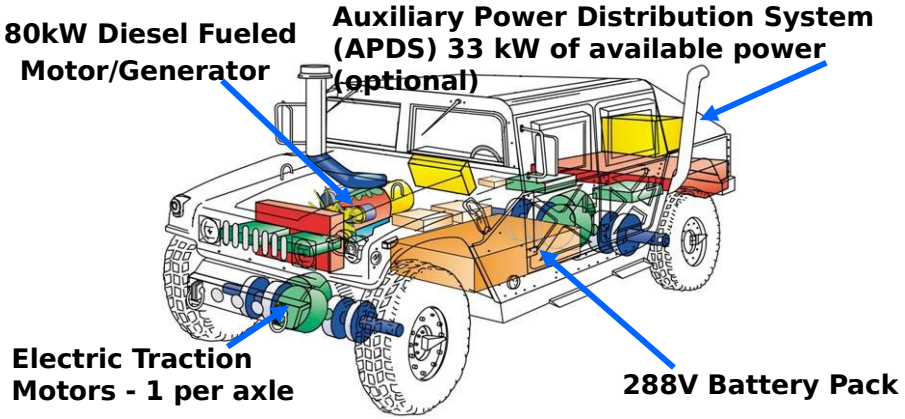
AGENDA

- What is HE HMMWV
- Current Testing
  - Purpose/Trade-Offs
  - Define Military Environment
  - 3 Criteria
  - Performance
  - Incident Summary
  - Lessons Learned
  - Update
- Where do we go from here?

HYBRID ELECTRIC (HE) HMMWV - XM1124

Description

- Replaces the conventional HMMWV drive train with a hybrid drive train while retaining the capabilities of the standard HMMWV
- Quiet, mobile platform for silent watch, reconnaissance missions
- Reduced thermal and acoustic signatures
- Power generation capability


80kW Diesel Fueled Motor/Generator
Auxiliary Power Distribution System (APDS) 33 kW of available power (optional)
Electric Traction Motors - 1 per axle
288V Battery Pack

Key Requirements

- ***Decrease fuel consumption: 30%***
- ***Provide 33 kW of continuous power***
- ***C130 Transportability***
- Multi-phase mobile power (AC/DC)
- Maintain HMMWV capabilities; mobility, transportability, and payload.
- Two level maintenance
- Open Architecture for upgrades

Acquisition Requirements

- Required Vehicles: Up to 20,500 (estimated)
  - 1,500 Scout/RSTA
  - 19,000 Shelter Carriers
- Contract: Sole Source AMG - FFP July 2003
  Design – CPFF Dec 2003

Program Status

- Systems Demonstration Phase
- Req capability in TRADOC approved HMMWV ORD
- Modernization under HMMWV JMENS & Addenda
- Meet CSA Guidance to reduce Logistics

Concessions

- **$4.5M development project**
- **COTS solution**
- **Knew only “resistant” to water**
- **EMI not considered except for interference of test equipment**
- **Integration of APDS was afterthought**
- **System Support Package**

Military Environment

Military Environment

ATC Video

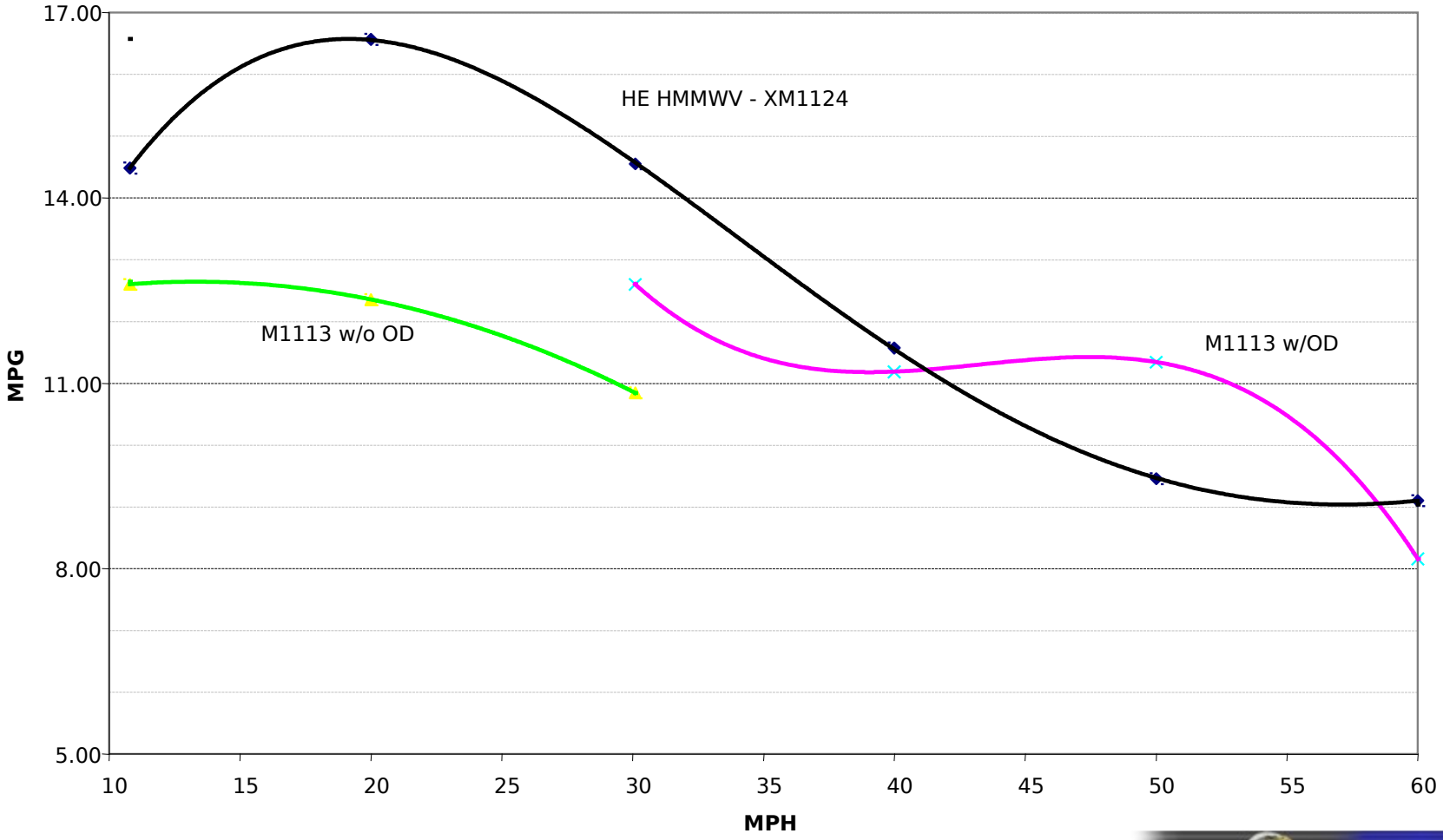
3 "Exit" Criteria Power Generation

	400 Hz TQG Set (2000 RPM) @15kW	HE1 @15 kW
Load	Gal/Hr	Gal/Hr
RL	1.41	1.41
3/4 RL	1.17	1.15
1/2 RL	0.93	0.79
1/4 RL	0.71	0.55
No Load	0.54	0.11

- 35kW DC
- TQG Power
  - 50/60/400 Hz
  - 120/208 3 phase
- 60 Hz @ .8pf
  - 15kW for 8 hours
  - 30kW for 8 hours

3 “Exit” Criteria
Fuel Consumption

Fuel Economy
(Road Load - Interpolated Data)



3 "Exit" Criteria
Fuel Consumption

- Mission Profile – standard fuel course was completed in April w/HE1
  - 30 % Primary: Paved Surface
  - 30 % Secondary: Perryman A, Munson Belgian Block & Gravel
  - 40 % Cross Country: Perryman 1, 2, & 3, Churchville B Course

	Weight	Miles	Fuel	MPG	ton-mile/gal
M1113	6,160	879	94.6	9.3	29
XM1124	8,160	937	109.8	8.5	35
M1113	11,500	391	54.0	7.2	42
XM1124	12,100	500	46.8	10.7	65

- MPG Comparison: @ CW: -8.2%
  @ GVW: 47.6%
- Ton-Mile/Gallon: @ CW: 21.7%
  @ GVW: 55.2%

3 "Exit" Criteria
Air Transportability

- S250 Shelter installed on vehicle HE1
  - Highest Point: 110.1 inches
- Snubbing Kit installed to bind suspension
  - Highest Point: 104.4 inches

Predictions/Results

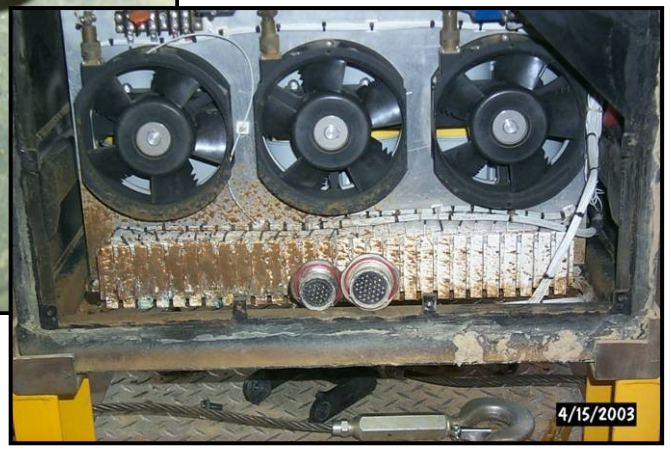
- Acceleration
  - Prediction — Actual
    - 0-30: ~7 seconds — 9.26 seconds
    - 0-50: ~22 seconds — 30.93 seconds
- Grade
  - Prediction – 44%
  - Actual – Able to fully ascend/descend 40% (failed 50%)
- Speed
  - Prediction – 56 mph
  - Actual
    - Hybrid: 59.1 mph
    - All Electric: 57.4 mph

Test Matrix

- 100 Test Incidents from ATC and YPG
  - BCU/SCU (16)
  - APC (13)
  - Batteries (12)
  - Traction Motor/Motor Controller (10)
  - Engine (9)
  - Power Steering (8)
  - PGU (5)
  - MU (5)
  - Coolant Pump (3)
  - DC/DC (1)
  - PDU (1)
  - Miscellaneous – loose cables and such (17)
- 44% of incidents related to hardware
- 10% of incidents related to software
- 14% of incidents related to maintenance
- 15% of incidents are as of yet unassigned
- 17% of incidents are generic

Lessons Learned

- Water/Mud
  - Conditions surprised us all
  - Motors
- APDS
  - Communication between truck and APDS
- Tester Training
  - Maintenance
  - Operation
  - Vehicle peculiarities
- Communication
  - Among PM's
  - Contractors
  - Detailed Test Plan
- Software
  - Configuration Control
  - "Catch All" Solution
- Fuel Consumption
- Safety
- FSR's
- Batteries
  - Maintainability
  - Individual module replacement not reasonable



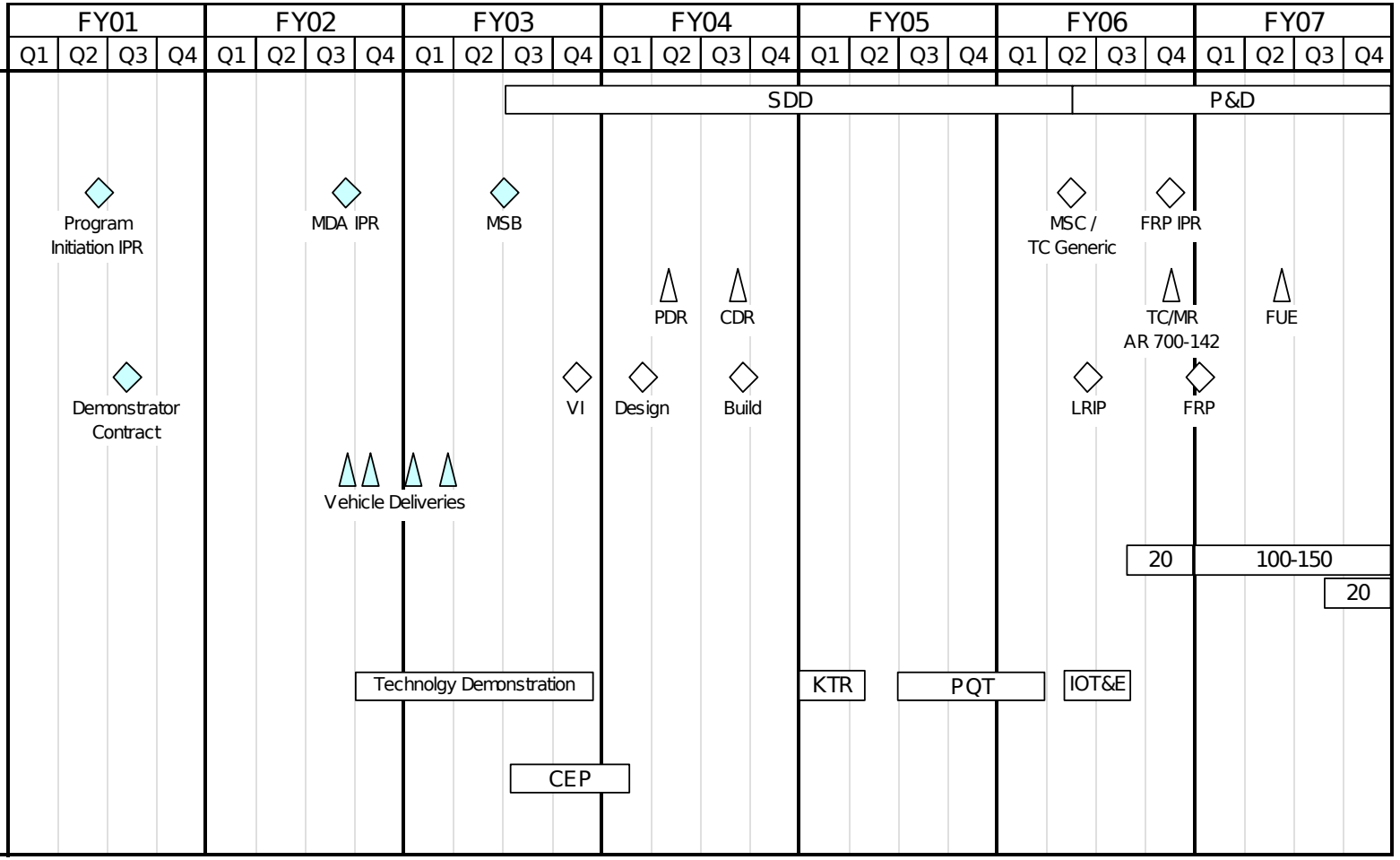
Update

- 5823 miles accumulated to date
  - HE2 – 2911
  - HE3 – 1750
  - HE4 – 1162
- HE1
  - Ft Benning for Concept Experimentation Program
  - Limited use
  - Incidents
    - Generator Failure
    - Drained LSI batteries
- HE4
  - Delivered to Benning week of 23 June 2003

Update (cont'd)

- HE2
  - Continues testing at ATC
    - Full Load Cooling Test
    - Endurance Miles @ GCW
  - APDS safety release?
- HE3
  - At AMG undergoing refurbishment
  - Ft Benning (dependant upon current asset usage)

Schedule



30 June 2003